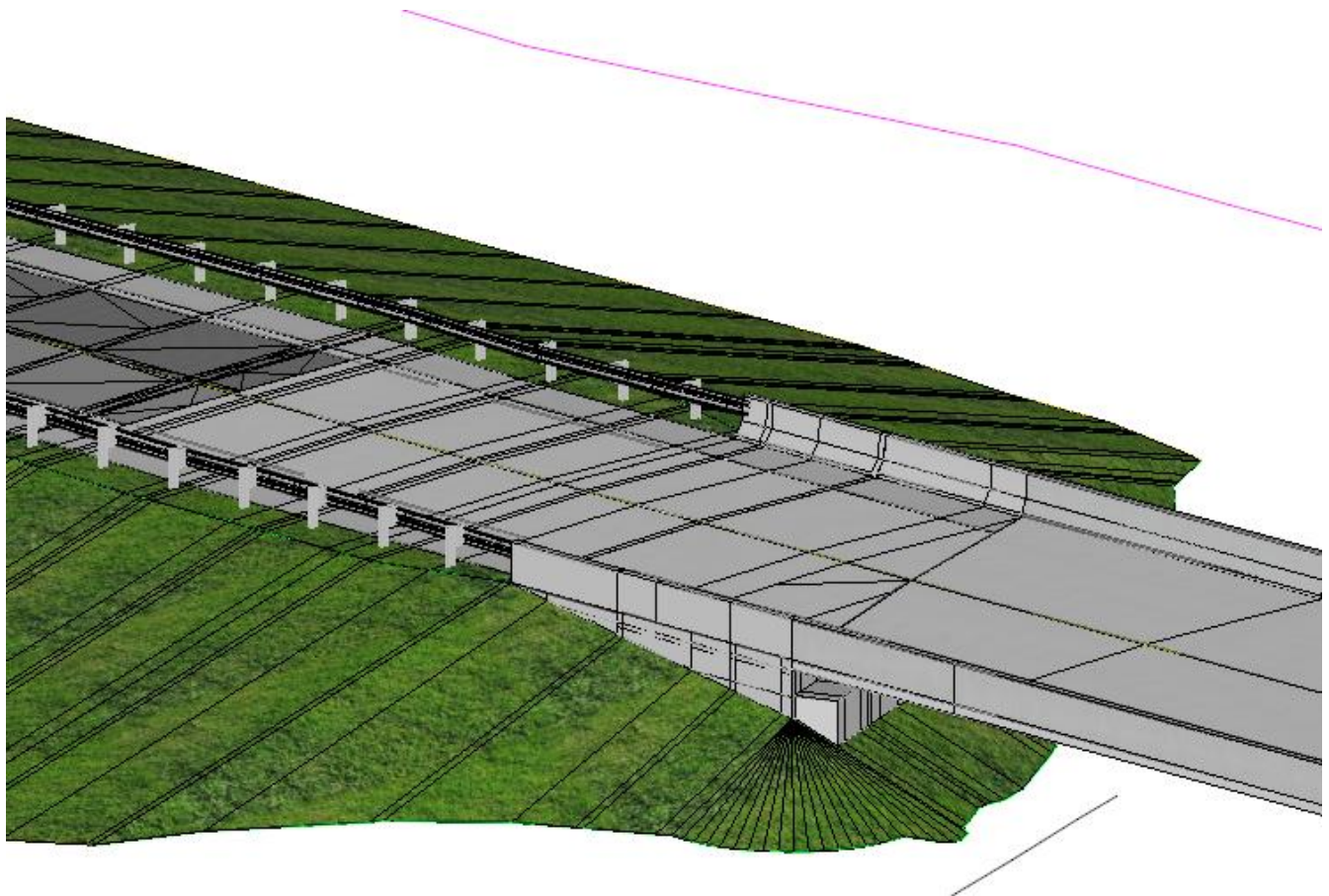

GeoPak Road 2

Bridge End-Bent Layout



19.1 Group Exercise: Bridge End-Bent Layout

- 1) Open the **Pike\J2P3081\data\J2P3081_Survey.dgn**.
 - a) Review the Survey File.
 - b) Using the Level Display turn off all levels except for ones for the Existing Edge of Pavement and Shoulder, and Terrain Modeling.
- 2) Create **J2P3081_Civil_Geometry.dgn** using the **i_project_2d_PowerGEOPAK.dgn** as the seed file.
 - a) Set Annotation Scale to **50**
 - b) Import Alignment and Profile called “**Mainline**” and “**Proposed**”
 - c) Reference in the **J2P3081_Survey.dgn**, activate Existing Terrain
 - d) Open Profile Model, activate Proposed Profile (if needed)
- 3) Open **J2P3081_Plan.dgn** File.
 - a) Review plan geometry.
 - b) Attach **J2P3081_Civil_Geometry.dgn**
- 4) Create **J2P3081_Corridors.dgn** using the **i_project_2d_PowerGEOPAK.dgn** as the seed file.
 - a) Reference in **J2P3081_Survey.dgn**
 - b) Reference in **J2P3081_Plan.dgn**
 - c) Reference in **J2P3081_Civil_Geometry.dgn**
 - d) Activate Existing Ground Terrain.
 - e) Open Project Template Library (**J2P3081.itl**)
 - f) Review Bridge and Roadway templates listing in the **J2P3081** folder.
 - g) Close Template Library.
 - h) Select the “**Create Corridor**” tool.
 - i) Name the corridor “**Route14**”
 - j) Apply Roadway template “**2 Lane w/ Agg Base Option 1 Mill and Fill Concrete Widening**” from station **68+00** to **71+68.64 R1** with Drop Interval of **25ft**.
 - k) Select the “**F6**” key to open 3D view of model.
 - l) Notice Survey Text showing up in 3D View and XS View. To stop the Survey Text from showing up see next step.
- 5) Open the **J2P3081_Survey.dgn**.
 - a) In Level Display turn on all Levels
 - b) Select **Project Explorer>Survey Tab>Survey Data>Default>Field Books>673ADT13**
 - c) Uncheck the box next to “**All Point Features**”
 - d) Uncheck the box next to “**All Linear Features**”
 - e) Expand the leaf next to “**All Linear Features**” and check on the box next to: **121 & 207** (Existing Edge of Shoulder and Pavement).

- 6) Reopen **J2P3081_Corridors.dgn** file
 - a) Verify no Survey text is in 3D and XS View.
 - b) In 2D Corridor View turn off Corridor 3D reference file.
 - We do so to remove clutter from 2D View (Personal Preference)
 - c) Add Existing EOP (Survey Feature 207) lines as Corridor References.
 - d) Add the “EOP New” lines as Corridor References.
- 7) Add following Parametric Constraints to remove Pavement Widening on Left side ending at Station **70+52.89**.

Start:	67+00.00
Stop:	70+52.89
Constraint Label:	LT_Pvmt_Surf_Conc_Width
Start Value:	0.00
Stop Value:	0.00

- 8) Open Dynamic XS model, and display XS at Station **71+68.63 R1**
 - a) Verify that the pavement slopes on left and right side.
 - b) Left = 0.52% Right = -0.79%
- 9) Apply Roadway/Bridge Approach template.
 - a) Review **Concrete Approach Pavement with Barrier** Template (focus on Display Rule for Type “B” Barrier)
 - b) Apply **Concrete Approach Pavement with Barrier** from station **71+68.65 R1** to **72+37.00 R1**
 - c) Use a drop spacing of 1ft
- 10) Add the following two Parametric Constraints to transition Concrete Approach Pavement Slopes into Overlay Pavement Slopes:

Parametric Constraint #1

Start:	71+68.65
Stop:	71+78.65
Constraint Label:	LT_Pvmt_Surf_Conc_Slope
Start Value:	0.52%
Stop Value:	2.0%

Parametric Constraint #2

Start:	71+68.65
Stop:	71+78.65
Constraint Label:	RT_Pvmt_Surf_Conc_Slope
Start Value:	-0.79%
Stop Value:	-2.0%

- Note if gap in slope between the two templates is not resolved, check to make sure the existing ground terrain is active.

- 11) Create a terrain model from the 3D Model. This terrain Model will be used to create a profile around the Bridge End Bent.
 - a) Create new file called **J2P3081_Graphic_Filter.dgn** using a 3D Seed.
 - b) Reference in the **J2P3081_Corridors.dgn** and its **Default-3D** view.
 - c) Select the **Create Terrain Model by Graphic Filter**.
 - d) Use a Filter Group called **Design – Proposed Finish Grade with Boundary**.
 - e) Use Feature Definition of **Design Triangles**.
 - f) Name the new Terrain model “**J2P3081 Terrain from Graphic Filter**”
 - g) Turn off Reference and Rotate View and view terrain.
- 12) Create Horizontal and Vertical Civil Alignment End Bent Corridor:
 - a) Open J2P3081_Plan.dgn
 - b) Use Horizontal Geometry **Complex by PI** Tool and trace end bent counterclockwise.
 - a. Use radius of 0.00’
 - b. Use Feature Definition => **Bridge Approach Slab_503-10.00**
 - i. (Located under: **Design\Design Standards\Safety and Structures**)
 - c. Use Feature Name “**End_Bent_1**”
 - c) Reference in **J2P3081_Graphic_Filter.dgn**
 - a. If triangles are turned on, go into the properties of the Terrain Model and override the symbology and turn triangles off.
 - d) Select **End Bent 1**’s Alignment and open its Profile Model.
- 13) Use Vertical Geometry Tool Quick Profile from Surface to create a profile from Graphic Filter Surface.
 - a) Name the profile “**Proposed**”
 - b) Set profile **Active**.
- 14) Open **J2P3081_Corridors.dgn** file
- 15) Add the **Traffic Control Barrier Lines** near the End Bent as Corridor References.
- 16) Add the following two Parametric Constraints to transition in the Guardrail Widening Width over a distance of 10ft near the Bridge Approach slab:

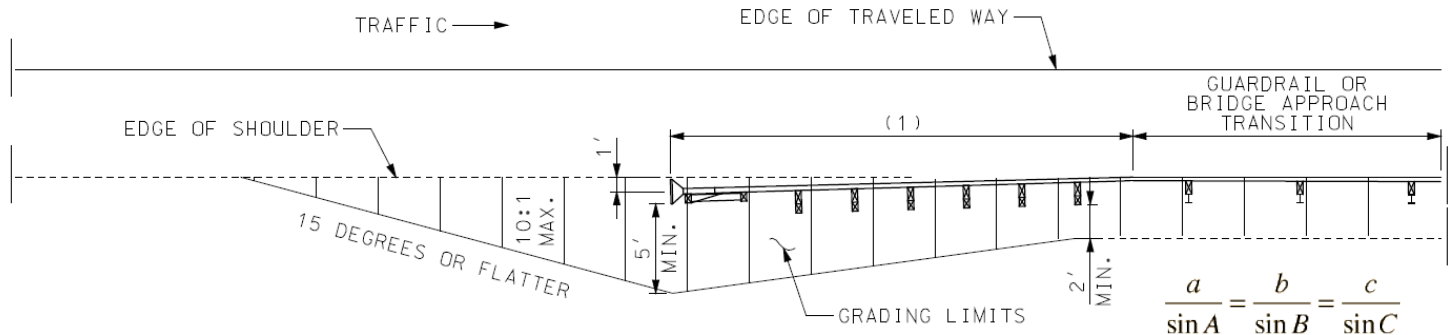
Parametric Constraint #1

Start:	71+87.89
Stop:	71+97.89
Constraint Label:	LT_Guardrail_Widening_Width
Start Value:	-3.9375’
Stop Value:	-1.34’

Parametric Constraint #2

Start:	72+00.52
Stop:	72+10.52
Constraint Label:	RT_Guardrail_Widening_Width
Start Value:	3.9375’
Stop Value:	1.34’

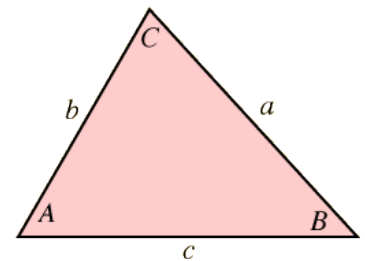
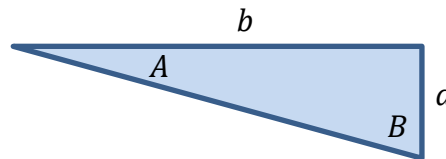
- 17) Review below the Guardrail Widening Width requirements on the right side of Route 14 to meet our requirements in the Standard Plans 606.80.



Using the **Law of Sines** calculate the transition Length.

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{7\text{ft}}{\sin(15^\circ)} = \frac{b}{\sin(90^\circ - 15^\circ)}$$



$$b = \left(\frac{\sin 75^\circ}{\sin 15^\circ} \right) (7\text{ft}) = 26.12\text{ft}, \text{ use } 30\text{ft for Guardrail Widening Transition Distance.}$$

- 18) Modify the Guardrail Widening Width requirements on the **both sides** of the Mainline using the following Parametric Constraints to meet MoDOT's requirements in the Standard Plans 606.80.

Parametric Constraint #1

Start:	Start of Alignment
Stop:	68+70
Constraint Label:	Guardrail_Widening_Width
Start Value:	0.00 ft
Stop Value:	0.00 ft

Parametric Constraint #2

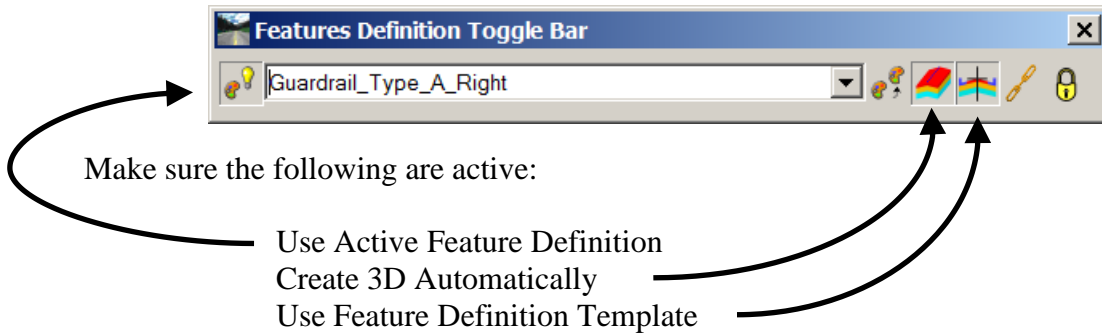
Start:	68+70
Stop:	69+00
Constraint Label:	Guardrail_Widening_Width
Start Value:	0.00 ft
Stop Value:	7.00 ft

Parametric Constraint #3

Start:	69+00
Stop:	69+30
Constraint Label:	Guardrail_Widening_Width
Start Value:	7.00 ft
Stop Value:	3.9375 ft

- 19) In the Corridors_J2P0200.dgn 2D Default View, if it is on, turn off the 3D reference from the Corridors 3D Model.

- 20) Set the Feature Definition to: Design/Design Standards/Safety and Structures/Guardrail_Type_A_LT/RT



- 21) Using the **Horizontal Geometry - Variable Offset Taper** along with Civil AccuDraw tool, place on **both** side of the roadway the 1ft offset taper section of the guardrail.

Variable Offset Taper Settings

Notes:

- If your guardrail looks like a block, in the View Attributes turn off the **Construction** View.
- If a very tall guardrail post draw, select the “**F4**” Key.

Locate Element:	Proposed Edge of Shoulder
Start Offset:	1.00
End Offset:	0.00
Start Station:	69+00
End Station:	69+30
Feature Definition:	Guardrail_Type_A_LT/RT

- 22) Using the **Horizontal Geometry – Single Offset Partial** along with Civil AccuDraw tool, place on the left side of the roadway the following section of the guardrail.

Single Offset Partial Settings Left

Locate Element:	Proposed Edge of Shoulder
Start Offset:	0.00
End Offset:	0.00
Start Station:	69+30
End Station:	71+80.11
Feature Definition:	Guardrail_Type_A_Left

Variable Offset Taper Settings Left

Locate Element:	Proposed Edge of Shoulder
Start Offset:	0.00
End Offset:	-0.50
Start Station:	71+80.11
End Station:	71+98.49
Feature Definition:	Guardrail_Type_A_Left

- Note: You’ll notice that the Guardrail meanders in and out, because it is tied to the edge of shoulder line. To remove the meander tie the outside shoulder line to the baseline at a 16 feet offset, in other words within the **LT_Conc_T_O_EOS** point make the parent point of the Horizontal Constraint be the **AsphSurf_T_CL** point and set the distance to 16 feet.

- 23) Using the **Horizontal Geometry – Single Offset Partial** along with Civil AccuDraw tool, place on the **right** side of the roadway the following section of the guardrail.

Single Offset Partial Settings Right

Locate Element:	Proposed Edge of Shoulder
Start Offset:	0.00
End Offset:	0.00
Start Station:	69+30
End Station:	71+98.75
Feature Definition:	Guardrail_Type_A_Right

Variable Offset Taper Settings Right

Locate Element:	Proposed Edge of Shoulder
Start Offset:	0.00
End Offset:	0.50
Start Station:	71+98.75
End Station:	72+11.02
Feature Definition:	Guardrail_Type_A_Right

- 24) Create/Apply a **Linear Template Drop** for End Bent #1.

Locate Element:	The End_Bent_1 Horizontal Linear Feature
Start Station:	Lock to Start
End Station:	Lock to End
Exterior Sweep Angle:	5 degrees
Mirror:	No
Reflect:	No
Template:	2:1 Earth Slopes with Upper Concrete Structure
Design Stage:	Design
Description:	End Bent #1

- 25) Add Corridor Clip to the Mainline Corridor
 ○ Clip out the End Bent **Linear Template**.

- 26) Using Parametric Constraints adjust the **End Bent #1** Linear Template Drop:

Parametric Constraint #1
(Bench Width)

Start:	Lock to Start
Stop:	0+25.00
Constraint Label:	Bench_Width
Start Value:	0.00 ft
Stop Value:	0.00 ft

Parametric Constraint #2
(Bench Width)

Start:	0+61.90
Stop:	Lock to End
Constraint Label:	Bench_Width
Start Value:	0.00 ft
Stop Value:	0.00 ft

27) Continue using Parametric Constraints adjust the End Bent #1 Linear Template Drop:

Parametric Constraint #3
(Wall Depth)

Start:	Lock to Start
Stop:	0+25.00
Constraint Label:	Wall_Depth
Start Value:	0.00 ft
Stop Value:	-4.00 ft

Parametric Constraint #4
(Wall Depth)

Start:	0+61.90
Stop:	Lock to End
Constraint Label:	Wall_Depth
Start Value:	-4.00 ft
Stop Value:	0.00 ft

Parametric Constraint #5
(Fill Slope)

Start:	Lock to Start
Stop:	0+25.00
Constraint Label:	Fill Slope
Start Value:	-25%
Stop Value:	-50%

Parametric Constraint #6
(Fill Slope)

Start:	0+61.90
Stop:	Lock to End
Constraint Label:	Fill Slope
Start Value:	-50%
Stop Value:	-25%

28) To Clip out the remaining piece of the Mainline Corridor create a “**Clipping Corridor**”.

- Create a new 2D file called **J2P3081_Clipping_Corridors.dgn**
 - Reference in the following:
 - **J2P3081_Plan.dgn**
 - **J2P3081_Corridors.dgn**
- Use the MicroStation Move Parallel tool and offset end bent line.
 - Offset line 0.01 up station using the **MicroStation Move/Copy Parallel Tool**.
- Extend the offset line well past Corridor Limits.
- Set Feature Definition of the new offset line to **Design/Design Standards/Safety and Structures/Bridge (New)**
- Create Profile with constant elevation 400’
 - Use the **Profile by Constant Elevation Tool**
- Apply Linear Template to Alignment and profile

Locate Element:	The 0.01’ Offset Line created from End_Bent_1
Start Station:	Lock to Start
End Station:	Lock to End
Exterior Sweep Angle:	
Mirror:	No
Reflect:	No
Template:	Clipping Template
Design Stage:	Design
Description:	Roadway Clip

29) Open J2P3081_Corridors.dgn

- Reference in **J2P3081_Clipping_Corridors.dgn**
- Add Clipping Reference to **Route14** (Mainline) Corridor
- In the Reference Dialog turn **off** display to the **J2P3081_Clipping_Corridors.dgn**

30) Create a new 2D Bridge Corridors file named **Corridors_Bridge_J2P3081.dgn**.

- Reference in the following:
 - **J2P3081_Plan.dgn**
 - **J2P3081_Corridors.dgn**
 - **J2P3081_Civil_Geometry.dgn**

31) Apply Bridge Template to the Mainline Horizontal Linear Feature.

Alignment:	Mainline
Corridor Name:	Bridge
Template:	Bridge
Start Station:	72+20
End Station:	73+50
Drop Interval:	25.00’
Minimum Transition Before Drop:	0.00’
Minimum Transition After Drop:	0.00’
Description:	Bridge

- 32) Open once again the **J2P3081_Clipping_Corridors.dgn** and create another “Clipping Corridor” to clip out Bridge Template in the **Corridors_Bridge_J2P3081.dgn** file.
- Use the same **Bridge (New)** Civil Element created in **step 28**.
 - Apply the following Linear Template Settings to Alignment and Profile

Locate Element:	The 0.01’ Offset Line created from End_Bent_1
Start Station:	Lock to Start
End Station:	Lock to End
Exterior Sweep Angle:	
Mirror:	No
Reflect:	No
Template:	Clipping Template
Design Stage:	Design
Description:	Bridge Clip

- 33) Open **Corridors_Bridge_J2P3081.dgn**
- Add Clipping Reference to Bridge Corridor
 - In the Reference Dialog turn **off** display to the **J2P3081_Clipping_Corridors.dgn**
- 34) Open **J2P3081_Corridors.dgn**
- Reference in the **Corridors_Bridge_J2P3081.dgn**
 - Review Project